

Part 1 – Flow Control Summary

For clarity in regard to Ecology's decisions, here is a summary divided into the categories of basins above and below 40% TIA; new and redevelopment projects; and projects above and below the Ecology thresholds:

For basins with less than 40% TIA:

- New development projects with 10,000 sq. ft. or more of effective impervious surface in a Threshold Discharge Area must use the Ecology default standard of matching flows produced by the historic land cover in the range of ½ the 2-year through 50-year flows. (No change from Ecology's initial comment)
- New development and redevelopment projects with between 2,000 square feet and 10,000 square feet of effective new and replaced impervious surface in a threshold discharge area may use the proposed Seattle standard of matching post-development discharge peak flow rates and flow durations to the pre-developed discharge rates from 50% of the 2-year recurrence interval flow up to the 2-year recurrence interval flow. (No change in Ecology's initial comment)
- Redevelopment projects exceeding 10,000 square feet of effective new and replaced impervious surface in a threshold discharge area may use the Seattle standard listed immediately above. (Change from previous correspondence based upon a comparison of flow reduction achieved by the Seattle thresholds and flow standards as compared to Ecology's).

For basins with more than 40% TIA:

- New development projects with less than 10,000 square feet of effective impervious area in a threshold discharge area may use the Seattle standard listed above. (No change in Ecology's initial comment)
- New development projects with an existing forested land cover and with 10,000 square feet or more effective impervious surface in a threshold discharge area must use the Ecology default standard. (No change in Ecology's initial comment)
- New development projects with an existing grass or pasture land cover and with 10,000 square feet or more effective impervious surface in a threshold discharge area may use the Seattle standard. (Change from previous correspondence based upon a comparison of Seattle's pasture standard to Ecology's grass standard.) Note that wherever the existing condition of a new development site is pasture, the Seattle standard is not as stringent as Ecology's because it only requires matching flows to the 2-year recurrence flow. Because a pasture pre-development condition (i.e., cleared but without any evidence of previous grading, filling and excavating) seems an unlikely occurrence in these highly urbanized basins, Ecology does not see a benefit in enforcing the Ecology standard.

However, Ecology encourages Seattle to expand its pasture standard to the full 50-year flow recurrence range. See our additional comments on this issue.

- The Seattle standard is acceptable for all redevelopment projects. (No change in Ecology's initial comment)

Seattle has revised its Code and manual to be consistent with the Ecology's decisions as indicated above. No further action necessary.

Part 2 - DIRECTOR'S RULES

Volume III:

Tables 4.4 through 4.8:

The tables implement a credit system that is intended to apply to sites below Ecology's flow control threshold for engineered facilities. Unfortunately, the tables do not take into consideration that a site may be below the flow control threshold of 10,000 square feet, but above the treatment threshold of 5,000 square feet of pollution-generating impervious surface (PGIS). For projects that have less than 10,000 sq. ft. of impervious surface, but more than 5,000 sq. ft. of PGIS, use of the tables will often result in smaller treatment facilities than use of Ecology's credits. The easiest fix is to indicate in the text (section 4.2.2, page 4-10), Figure 4.1, and the table headings that the pre-sized approach cannot be used to meet treatment requirements where PGIS exceeds 5,000 square feet. If the tables do not indicate this, Ecology has many objections to the credits listed in the tables. (Note: Table 4.7 for sidewalks and trail projects does not need the PGIS reference because they are Non-PGIS.)

□ RECOMMEND NO FURTHER ACTION.

It has been clarified that the credits, sizing factors, and sizing equations presented in this section are for flow control compliance only. A reference was added to point the designer to Section 5.8.5 where sizing factors are provided for selected infiltrating BMPs designed for water quality treatment standards.

Infiltration BMPs sized to meet the Seattle creek protection standard (predeveloped pasture standard) infiltrate 98.6 +/- 0.41 (mean +/- standard deviation) percent of the runoff volume and those sized to meet the capacity control standards infiltrate 99.8 +/- 0.1 percent of the runoff volume. Therefore, facilities sized for either flow control standard also meet the water quality treatment standard (requiring infiltration of 91 percent of the runoff volume) if imported or underlying soils meet the City's treatment requirements. See the attached memo entitled "Pre-Sized Approach for City of Seattle Stormwater BMPs" for supporting documentation.

No further action necessary.

Section 4.2.4.2: Scenario 2 –offsite flow management

If the allowable discharge rate is determined by only the onsite runoff calculations, the facility will be over-sized.

□ RECOMMEND NO FURTHER ACTION.

Agree that the facility will be over-sized for flow control. However, this requirement matches the requirement on sizing water quality facilities and may be applicable to combined water quality and flow control facilities. As this case is expected to be infrequent, we prefer to maintain the same logic with the water quality facility and handle internal bypassing as an exception.

No further action necessary.

Section 4.2.4.3: Scenario 3 – uncontrolled onsite flow management

The conditions under which an onsite area may bypass flow management facilities do not include a provision for meeting water quality requirements. Because Seattle does not have cost thresholds for application of treatment requirements to replaced impervious surfaces at redevelopment projects, and because the bypass area is limited to 1,000 square feet (as compared to Ecology's approximately 40,000 sq. ft), Ecology will not require the bypass area to meet treatment requirements.

□ **RECOMMEND NO FURTHER ACTION.**

The 1,000 sf bypass area was selected to allow only for incidental grade matching, for instance driveways. If the development includes new or replaced impervious surface of 5,000 sf of PGIS in the ROW, it will be treated there.

No further action necessary.

Section 4.3.4.2 Step 2: Setbacks and Site Restrictions

Because Seattle includes bioretention facilities under the category of infiltration facilities, this section would prohibit bioretention facilities within 5 feet of property lines (excluding property abutting the right-of-way). This would result in restricting bioretention facilities that are shared between adjacent properties. That seems to be an unnecessary restriction.

□ **Fixed.** Bullet has been modified to read: "Infiltration is not permitted within 5 feet from property lines (excluding the property line abutting the right-of-way) without agreement from neighboring property owner."

No further action necessary.

This section also prohibits infiltration within a groundwater protection area. That also seems to be an unnecessary restriction. Though Seattle may not have such protection areas, other cities that may choose to use the Seattle rules would apply this restriction. Instead of a prohibition, we suggest referencing a conservative set of design criteria that should protect the groundwater from stormwater pollutants.

□ **Fixed.** Bullet has been modified to read: "Infiltration is not permitted within a groundwater protection area unless approved by DPD. If approved, water quality treatment may be required."

No further action necessary.

Section 4.3.4.3

Ecology would like a statement that makes it clear that the thresholds are compared to the total area infiltrated on site, regardless of the number of infiltration facilities.

□ **Fixed.** A clarifying statement has been added.

No further action necessary.

Section 4.3.4.4:

In response to Ecology's question concerning use of a default of 0.25 inches per hour, Seattle referred Ecology to an attached memo entitled: "Recommended Baseline Infiltration Rate for Design." I cannot find that memo in the materials forwarded to me. Because the guidance only applies to redevelopment projects with less than 5,000 sq. ft. of impervious area infiltrating on-site, Ecology's concurrence with the assumption does not seem necessary. But given that other municipalities may want to apply similar designs, we will need this information.

□ RECOMMEND NO FURTHER ACTION.

See the attached memo entitled "**Recommended Baseline Infiltration Rate for Design**".

No further action necessary.

Section 4.4.1.2 Bioretention

Any bioretention facilities serving a project over 5,000 sq. ft. of PGIS, or 10,000 sq. ft. of impervious surface, or $\frac{3}{4}$ acres of lawn or landscape (even if the facility itself won't have a drainage area of those sizes) must have design criteria that result in equivalent pollution control and flow reduction benefit as the criteria in Appendix III-C of the Western Washington Stormwater Manual. The following criteria do not seem to be satisfied by the Seattle specification:

The first bullet is acceptable if the project does not exceed the above thresholds. Therefore, the text should indicate that it only applies to projects that do not exceed the above thresholds. The facility must meet the minimum specification to prevent groundwater pollution.

The second bullet option of amending the native soil in accordance with Section 4.4.5.2 does not meet the minimum criteria for treatment or flow control if the above thresholds are exceeded. It certainly can be used for smaller projects in accordance with the Seattle code.

In the third bullet, Section 5.8.5 is incorrectly referenced for soil specs. The reference should be Section 5.8.4.2. The Seattle turf specification would target only 4% organic content rather than the 10% target in the Ecology specification. Ecology could allow the lower organic content if Seattle could guarantee or require a minimum cation exchange capacity of 5 milliequivalents per /100 gms of dry soil, and put an upper limit on the short-term infiltration rate. Rates below 9 inches per hour may be acceptable. However, unless the aggregate specification is tightened (see comment on 5.8.4.2 below), use of the assumed rates in Table 4.9 for design are not approvable.

The section on underdrains should indicate that if a project exceeds the Ecology thresholds (5,000 PGIS, 10,000 impervious, or $\frac{3}{4}$ acre lawn or landscape), the facility must meet the Ecology design specifications if any treatment or flow control credit is desired.

□ RECOMMEND NO FURTHER ACTION.

See the attached memo entitled "**Updated SPU Bioretention Soil - Modeling Inputs and Water Quality Treatment**" demonstrating that the City of Seattle Bioretention Soil Specification meets Department of Ecology requirements.

No further action necessary.

The section on hydraulic restriction layers should indicate that no flow control credit is possible. Treatment credits are possible if Ecology minimum design criteria are followed. The amount of water passing through the underdrain system can be estimated using an approved continuous runoff model and subtracted from the total amount of flow that must receive treatment (i.e., 91 percent of the runoff file.)

□ RECOMMEND NO FURTHER ACTION.

Based on currently available modeling methods (i.e., WWHM3Pro) a bioretention cell with a liner and underdrain is capable of achieving the City's capacity control standard, but not the creek protection standard (predeveloped pasture). See the attached memo entitled "Pre-Sized Approach for City of Seattle Stormwater BMPs" for documentation.

No further action necessary.

Table 4.11:

Assuming this table is intended for projects above the Ecology thresholds, the table has two assumptions that result in not providing equivalent pollution protection:

Bioretention Soil Infiltration Rate: Cannot use the 2.5 in/hr assumed rate unless Seattle provides technical justification for that assumed rate (see comment on section 5.8.4.2 below).

- See the attached memo entitled "Updated SPU Bioretention Soil - Modeling Inputs and Water Quality Treatment" demonstrating that the City of Seattle Bioretention Soil Specification meets Department of Ecology requirements.

No further action necessary.

Bioretention Soil Depth: Must be 18 inches.

- Fixed. The City requires a minimum 12-inches of bioretention soil for flow control facilities and a minimum 18-inches of bioretention soil for water quality facilities. This clarification has been added to "Bioretention Soil" in Section 4.4.1.2 and Table 4.11.

No further action necessary.

Note that Seattle does not explain that in a Bioretention design, where the native soil layer is below an imported mix, the native soil layer does not need a reduction factor.

- Fixed. This clarification has been added to "Bioretention Soil" in Section 4.4.1.2, Table 4.11 and the discussion of correction factors in Appendix E.

No further action necessary.

Section 4.4.2.3:

It would be helpful if this section would make explicit that the storage reservoir consists only of the void volume of the aggregate base material which extends below surrounding grade.

□ Fixed. Per discussions with Department of Ecology dated 12-16-08, the basis of flow control credit for permeable pavement surfaces has been revised:

- Slopes < 2%: model permeable pavement surface as grass over underlying soil type or use explicit modeling methods or originally proposed explicit modeling method
- Slopes between 2 and 5%: model permeable pavement as 50% grass over underlying soil type and 50% impervious surface

See the attached memo entitled “Pre-Sized Approach for City of Seattle Stormwater BMPs” for documentation for revised flow control credits.

It has also been clarified that the slope criteria apply to the steepest slope in any direction (i.e., longitudinal or cross slope).

No further action necessary.

Section 4.4.6: Trees

Unlike the other green infrastructure BMP’s, this section does not have separate instructions for a “pre-sized approach” and “facility modeling.” Are we to assume that the credits apply to sites above the Ecology thresholds? Assuming that it is, the proposed credits need more bases for their justification.

□ Fixed. This has been discussed with Ecology (see below for additional details), and the text has been clarified that tree flow control credits apply to all sites regardless of size.

No further action necessary.

The previous draft from Seattle had indicated that credit would be given for impervious surfaces within 10 feet of the trunk of retained trees. The text now indicates that distance is 20 feet. (Although 10 feet is used at the top of page 4-96)

The previous draft and Table 4.4 indicate that credit would be given for impervious surfaces within 10 feet of newly planted trees. The text on page 4-97 indicates 20 feet.

□ Fixed. The revised maximum distance to impervious surface for both retained and newly planted trees is now consistently stated as 20 feet. As discussed in the meeting dated 12-16-08, the City increased the maximum distance to impervious surface to 20 feet. A distance of 10 feet may encourage people to place impervious surfaces too close to existing trees or to plant trees too close to impervious surfaces. This could risk pavement damage and long term health of the tree.

No further action necessary.

The last discussion with Seattle indicated that the credit for retained deciduous retained trees would be a minimum of 30 square feet. The current proposal lists 50 feet.

The last discussion with Seattle indicated that the credit for new deciduous trees would be a minimum of 15 square feet. The current proposal is 25 feet.

The concept of providing ½ the flow control credit for deciduous trees as is assigned evergreen trees may not be supportable. Flow control is necessary during the winter months when deciduous trees have no leaf cover.

□ Fixed. The issues listed above were addressed during discussions with the Department of Ecology dated 12-16-08. The credits provided in the table below were agreed upon at this meeting.

No further action necessary.

BMP	Type	Flow Control Credit (%)
Retained Tree	Evergreen	20% canopy area (min 100 sf)
	Deciduous	10% canopy area (min 50 sf)
New Tree	Evergreen	50 sf / tree
	Deciduous	20 sf / tree

In addition, a new maximum total tree credit was set at 25 percent of impervious surface requiring mitigation.

While Ecology had concerns about the deciduous tree credit being too high, it was agreed that the level of credit (10% of canopy area or 20 square feet per new tree) will not typically result in a significant flow control credit relative to site flow control requirements given tree spacing requirements, setback requirements and the maximum credit of 25%.

No further action necessary.

Under the “Tree location” sub-sections for retained and newly planted trees, the texts indicate a “higher credit” is given for trees that are 20 feet or less from existing ground level impervious surfaces and in the right-of-way.” What is a “higher credit?” This is confusing.

□ Fixed. The reference to a “higher credit” was a mistake and has been eliminated. Thank you.

No further action necessary.

Section 4.4.7.4: Flow Control Credit for Downspout Dispersion

Where an area being used for downspout dispersion is part of a drainage area that has triggered the 5,000 sq. ft. PGIS threshold, the dispersed impervious area should be monitored as a lawn.

□ Fixed. It has been clarified that downspout dispersion should be modeled as lawn over the underlying soil type for flow control credit. This modeling method was used to develop flow control credits for the Pre-Sized Approach as documented in the attached memo entitled “Pre-Sized Approach for City of Seattle Stormwater BMPs”.

No further action necessary.

Section 5.6.3.2:

In Table 5.10, please eliminate St. John’s wort. It is a listed noxious weed.

□ Fixed. St. John’s Wort has been deleted from the list of suitable groundcovers.

No further action necessary.

Section 5.7.3.2

It is more appropriate to use the adjustment factor, K, that is associated within on-line facilities. That correction factor is 1.65 instead of 3.

□ Fixed.

No further action necessary.

Section 5.8 Infiltration and Bio-infiltration BMP’s

Please explain the process and assumptions used for the “Sizing Factors” tables developed for infiltration trenches, drywells, bioretention facilities, and bioretention planters.

□ Fixed. See the attached memo entitled “Pre-Sized Approach for City of Seattle Stormwater BMPs” for supporting documentation.

No further action necessary.

Section 5.8.4.2.

I am not sure where to view Seattle’s current specification for bioretention soil designs. The response to comments indicates that it was submitted separately to Ecology. I do not know what document Seattle is referring to. I do not recall seeing such a document. However, the updated draft of the director’s rule refers the reader to a website. The website has a specification, 7-21, “Bioretention Soil for Turf and Landscape Areas” dated March ’08. Is this the latest specification that Seattle wants to be used?

The specification for the aggregate seems too loose based upon recent testing information from Curtis Hinman of WSU. Dr. Hinman’s study indicates that the percentage of materials passing the #200 sieve is critical for determining the final infiltration rate. A 2-3 % amount passing that sieve seems to provide infiltration rates in the correct range. Seattle’s specification allows 0 –

5%. Zero is not adequate as the resulting compost/aggregate mixture may pass water extremely fast. 5% seems to restrict infiltration to rates lower than Seattle's 5 inches per hour assumption.

□ Fixed. See the attached memo entitled "Updated SPU Bioretention Soil - Modeling Inputs and Water Quality Treatment" demonstrating that the City of Seattle Bioretention Soil Specification uses the same aggregate gradation as recommended by WSU, and that infiltration testing supports a 6 inch per hour assumption.

No further action necessary.

Table 4.9 lists an assumed short-term infiltration rate of 5 inches per hour. If a bioretention facility is going to be used to meet treatment requirements, either the compost/soil mixture has to be tested in accordance with section 7.7.4.1 of Appendix III-C of the West. Wash. Stormwater Manual, or Seattle must provide a more prescriptive aggregate specification and provide a corresponding infiltration rate based upon testing.

□ Fixed. The table has been renamed to "Infiltration rates for City of Seattle Turf and Landscape Bioretention Soil" and a footnote was added to direct readers to the specification. This clarifies that the infiltration rates listed correspond to the specified mix.

No further action necessary.

Section 5.9.6.2: Sand Filter Vaults

The reference to the design criteria for sand filter basins is incorrect. It should reference section 5.9.5. That would make this section consistent with the reference for linear sand filters, and also be a proper response to Ecology's original comment on sand media specifications.

□ Fixed

No further action necessary.

Appendix E:

The appendix uses text from the Ecology manual concerning correction factors to determine design infiltration rates from short term infiltration tests. That text often suggests use of factors on the low end or high end of the range indicated in Table 3.9 of Volume III of the Ecology manual. Because Seattle has not included that table in Appendix E or Sections 4.3, the reader does not have a basis for understanding the range of correction factors that Seattle would suggest. We suggest adding such a table.

□ Fixed. Table 3.9 has been added to Appendix E. It has also been clarified that the infiltration rate for native soil underlying imported bioretention soil does not need a correction factor.

No further action necessary.